NORTH SLOPE
RAPID ECOREGIONAL ASSESSMENT

Regional Mitigation Strategy for Northeastern NPR-A
Education Forum and Process Design Workshop
Fairbanks, Alaska
**March 31, 2015**

Project Team

University of Alaska

- **Alaska Center for Conservation Science**
  - **Alaska Natural Heritage Program (AKNHP - UAA)**

- **Institute of Social and Economic Research (ISER - UAA)**

- **Scenarios Network for Alaska & Arctic Planning (SNAP - UAF)**

- **Margaret J King & King & Associates**

Bureau of Land Management

- **National Operation Center (NOC)**
- **Alaska State Office**
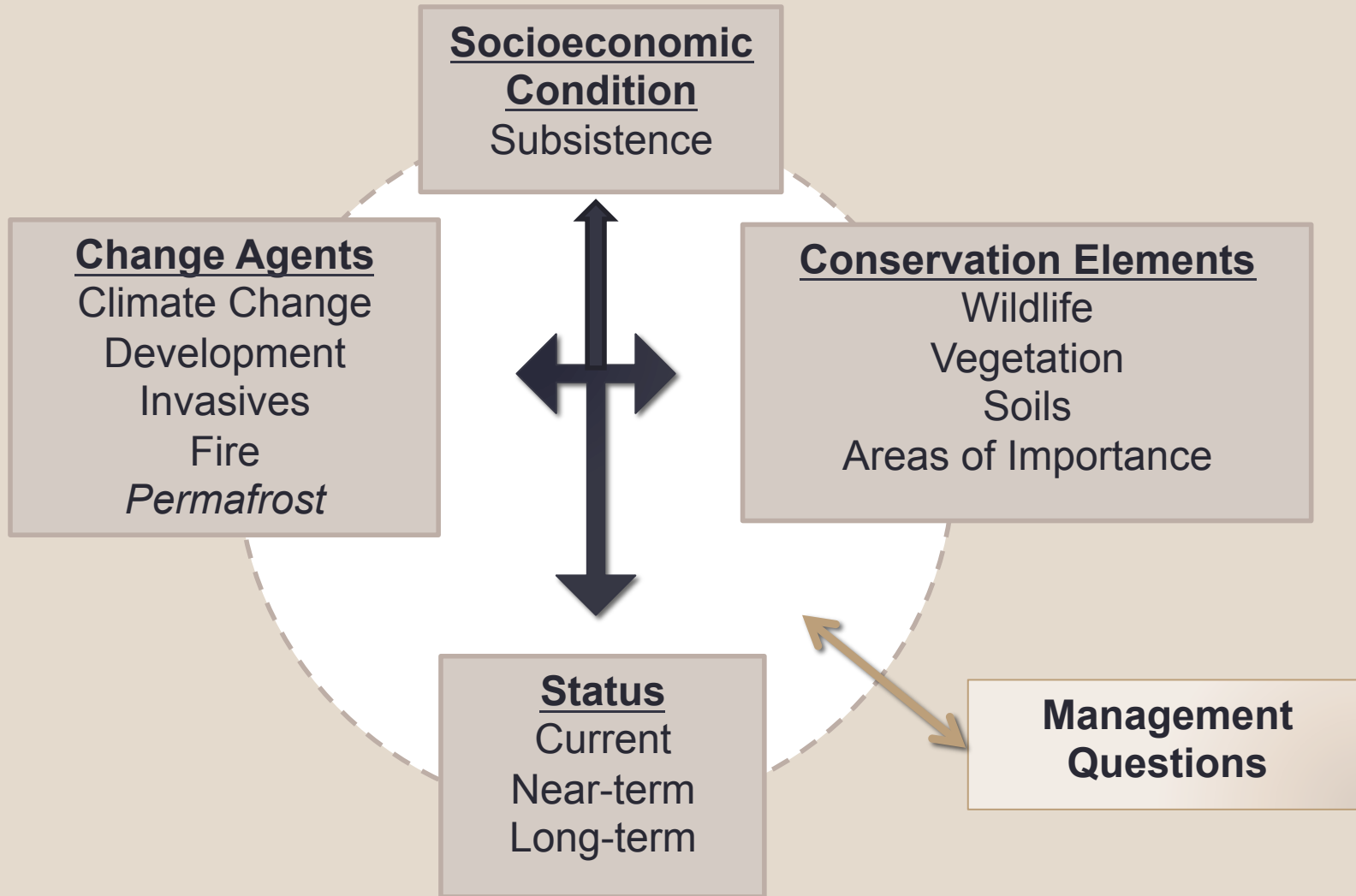- **Arctic Field Office**
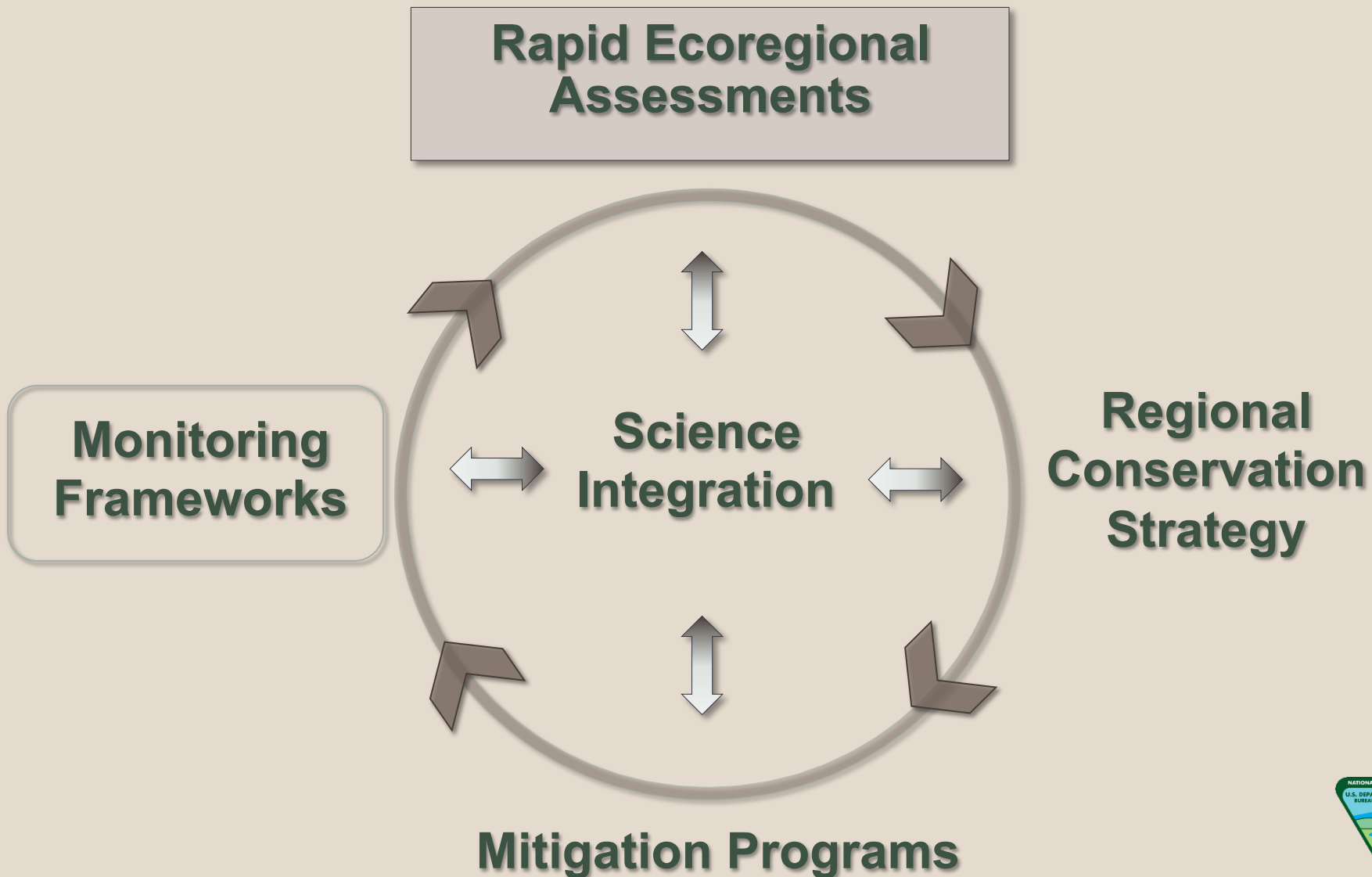
What is an REA?

An REA is a rapid assessment of **how regional ecosystem resources might change in the future**

Socioeconomic Condition
Subsistence

Change Agents
Climate Change
Development
Invasives
Fire
Permafrost

Conservation Elements
Wildlife
Vegetation
Soils
Areas of Importance

Status
Current
Near-term
Long-term

Management Questions

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Key Outcomes of REA

- Baseline conservation data synthesis
- Distribution models for key ecosystem resources
  - Conceptual model of how the ecosystem works
  - Following coarse-filter fine-filter approach
- Distribution models for major agents of change
  - Climate, wildfire, invasive species, human development and *permafrost*
- Intersection of two to show current and future (2025 & 2060) condition of ecological resources

Integration of Management and Science

Management Question Tract

Identify regional needs of resource managers

Science/Ecosystem Tract

Develop <u>conceptual model</u> of ecosystem components and key processes

Identification of species, habitat, changes that are significant for resource managers

Management and ecosystem-derived CEs and CAs are integrated to create a final suite for consideration by the AMT.
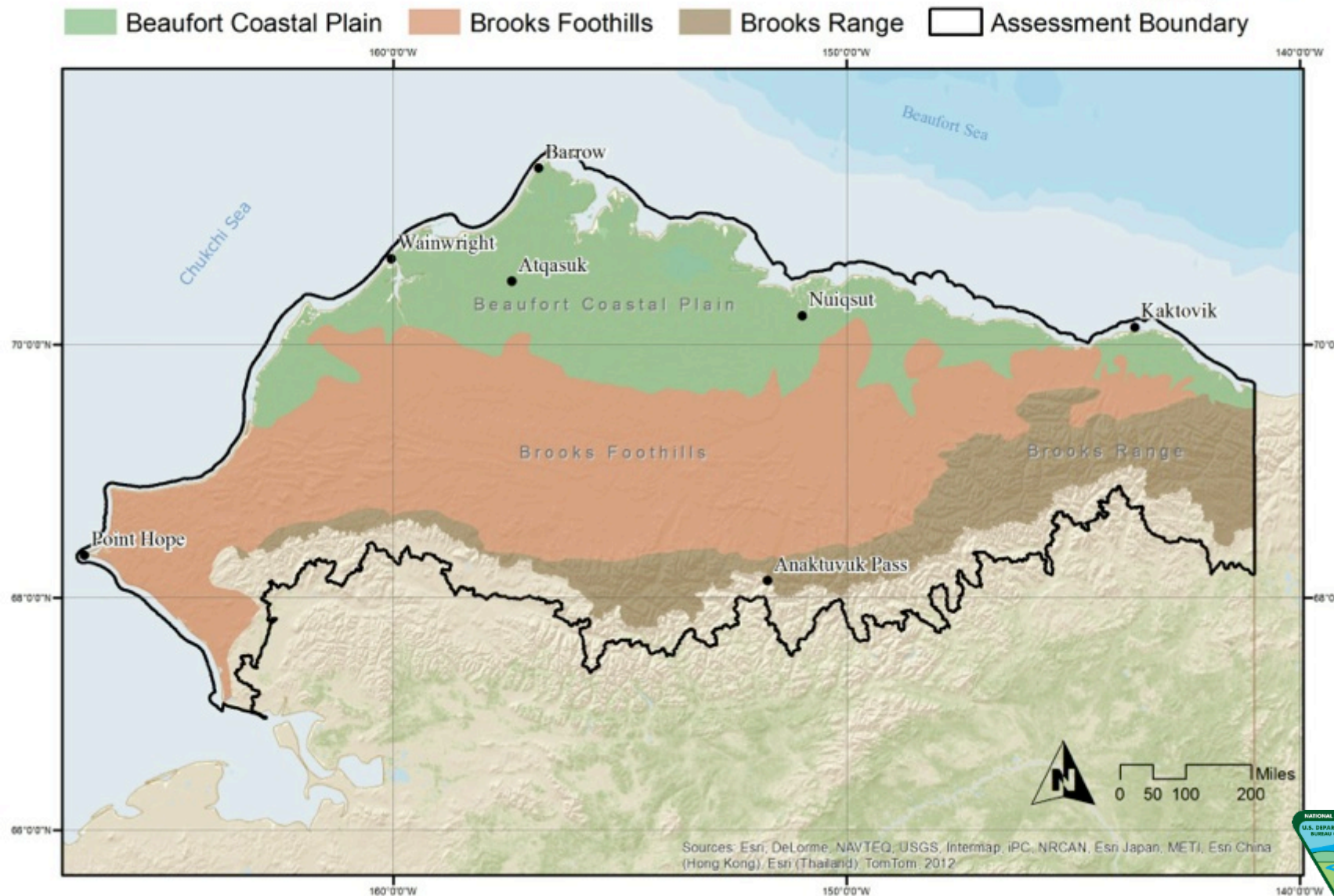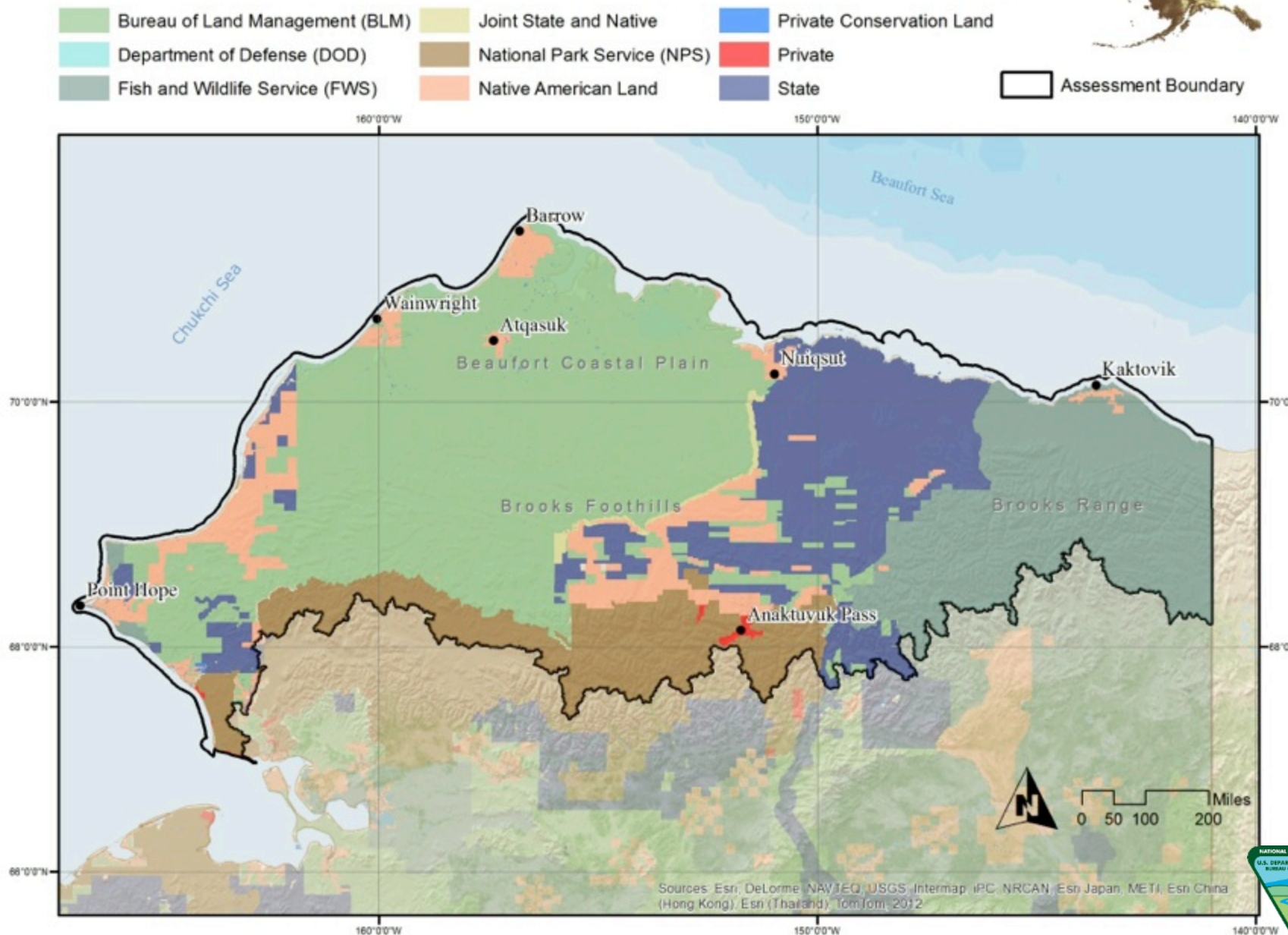
Identification of regionally significant CEs and CAs integral to model

North Slope Ecoregion Assessment Area

North Slope Ecoregion Land Ownership

Legend:
- Bureau of Land Management (BLM)
- Department of Defense (DOD)
- Fish and Wildlife Service (FWS)
- Joint State and Native
- National Park Service (NPS)
- Native American Land
- Private Conservation Land
- Private
- State
- Assessment Boundary

Barrow
Wainwright
Atqasuk
Nuiqsut
Kaktovik
Point Hope
Anaktuvuk Pass

Chukchi Sea
Beaufort Sea
Beaufort Coastal Plain
Brooks Foothills
Brooks Range

Rapid Ecoregional Assessment
BLM

Plants
- Vascular
- Non-vascular

Habitat availability, breeding, shelter
Herbivory

Pollination, herbivory, seed dispersal,
trampling

Animals
- Birds / Mammals
- Subsistence Harvesters
- Fish
- Invertebrates

Organic matter / Nitrogen inputs
Soil, water, and, snow retention
Soil structure / aeration
Soil insulation (freeze / thaw cycle

Nutrients and moisture
Rooting substrate
Decomposition

Nutrient input
Disturbance via trampling and digging

Habitat availability
Food availability

Habitat availability

Hydrologic change
Nutrient inputs

Predation

Soil, water, and snow retention

Soil Resources
- Soil
- Nutrients
- Microorganisms
- Moisture
- Permafrost and active layer

Nutrient input
Sediment, soil and water retention

Sediment and nutrient transport
Subsurface recharge / Erosion

Freshwater Resources
- Lakes
- Rivers
- Snow/Ice

Key Aquatic Habitats

Connected Lakes

Important breeding habitat for aquatic insects, fish, waterbirds and shorebirds and provide subsistence and recreational use

Disconnected Lakes

Important breeding habitat for aquatic insects, fish, waterbirds and shorebirds; flood storage, groundwater regeneration; invertebrate and waterfowl habitat

Streams

High stream connectivity in the summer, important spawning, rearing, and overwintering habitat

Key Terrestrial Species

Conservation Element (CE)	Ecosystem Function
Moose (*Alces americanus*)	Subsistence and prey resource, herbivory
Caribou (*Rangifer tarandus*)	Subsistence and prey resource, herbivory, vegetation disturbance (trampling)
Muskox (*Ovibos moschatus*)	Subsistence and prey resource, herbivory, vegetation disturbance (trampling)
North American beaver (*Castor canadensis*)	Mechanical disturbance, major driver of hydrologic change on aquatic and riparian ecosystems
Gray wolf (*Canis lupus*)	Predation (top level carnivore)
American peregrine falcon (*Falco peregrinus anatum*)	Predation (large avian predator); BLM Sensitive Species
Trumpeter swan (*Cygnus buccinator*)	Large bodied waterfowl, surrogate for condition and availability of freshwater resources; BLM Sensitive Species
Olive-sided flycatcher (*Contopus cooperi*)	Insectivorous avian predator; boreal forest indicator species; BLM Sensitive Species
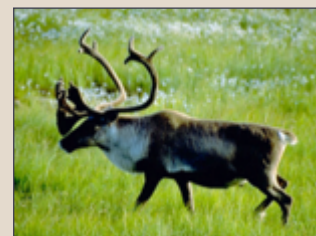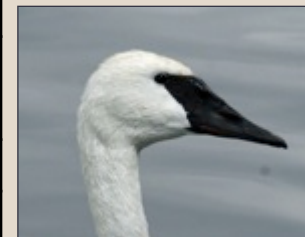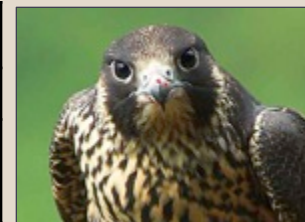
Change Agents

- Climate Change
  - However we want to conceptualize it
  - A2 scenario from IPCC IV, 5 GCM average

- Wildfire
  - Changes in return interval and successional response
  - ALFRESCO

- Invasive Species
  - Vulnerability of areas to becoming infested

- Land Use and Development
  - Trend future estimate of land use and development
  - NSSI Scenarios of future oil and gas development

Integrated Landscape Integrity

- Landscape condition
  - Model of intactness
- Assess current and future *status* of key species and habitats
  - Look at intactness of underlying habitat
- Combine to get a sense of ecological integrity
- Assess key attributes of species and habitats that make them susceptible to change
  - Develop indicators for how specific variables might impact habitat availability
- Cumulative impacts
  - Where on the landscape do we expect to see the most change?

Cumulative Impacts Model (CIM)

Watersheds that are likely to change

Future (2025 & 2060)		Current (2010)	

Mean January Temperature − Mean January Temperature → > 1.3° C → Increased winter temperature

Mean July Temperature − Mean July Temperature → > 2.4° C → Increased summer stress

Annual Precipitation − Annual Precipitation → > 7 mm → Changes in water availability

Areas of Permafrost (< -1 C @ 1m) − Areas of Permafrost (< -1 C @ 1m) → > 20 km^2 → Loss of permafrost

Active Layer Thickness − Active Layer Thickness → > 10 cm → Changes in ALT

Invasive Species Vulnerability − Invasive Species Vulnerability → > 0 → Change in invasion vulnerability

Cumulative Impacts by 2025

CI Score

☐	0	■	4
☐	1	■	5
☐	2	■	6
☐	3		

Cumulative Impacts by 2060

CI Score

Willow Ptarmigan Status

Landscape Condition within the Distribution of Willow Ptarmigan
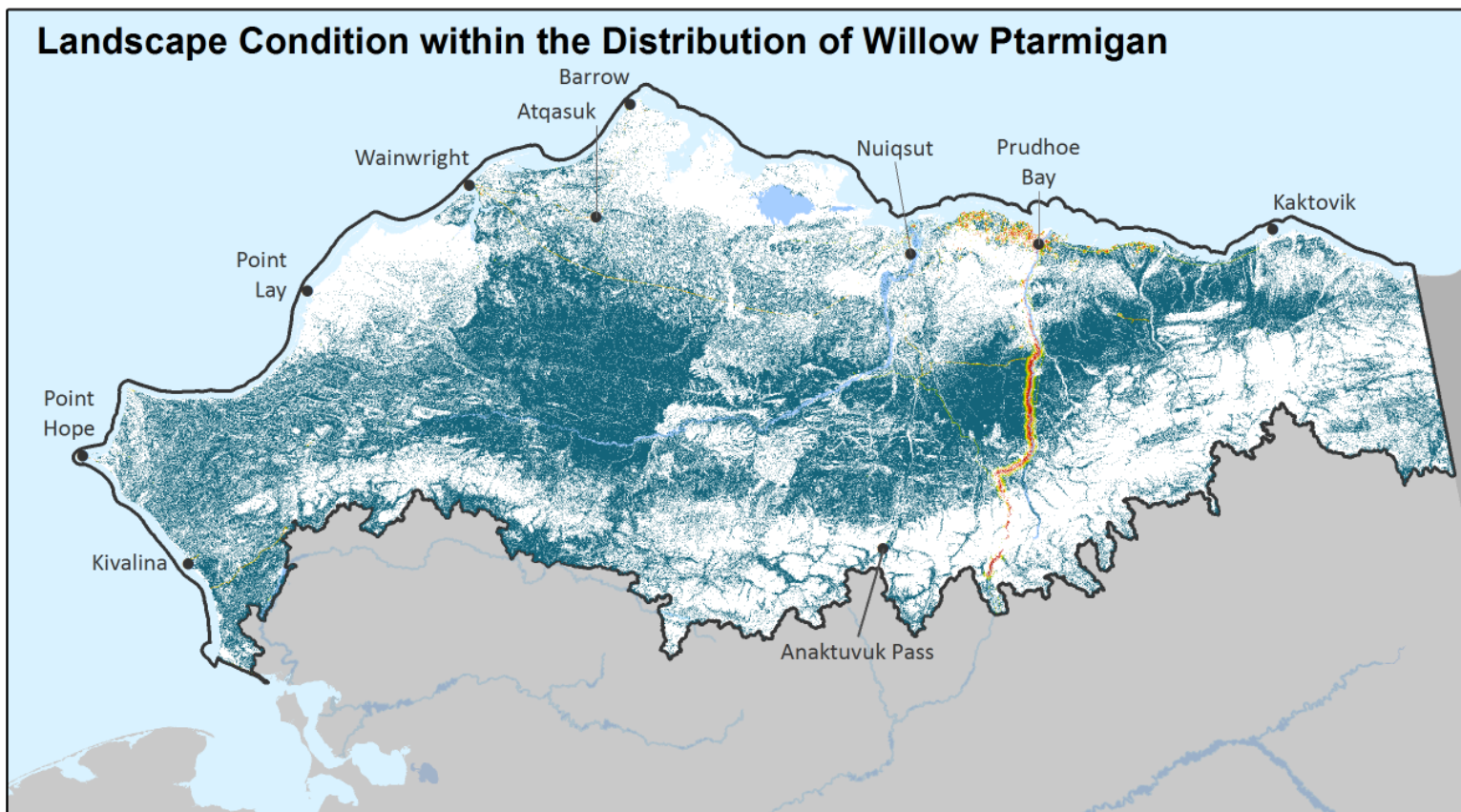
Landscape Condition within the Modeled Distribution of Willow Ptarmigan

Legend:
- Distribution of Willow Ptarmigan
- 0.0 – 0.2: Very Low
- 0.2 – 0.4: Low
- 0.4 – 0.6: Medium
- 0.6 – 0.8: High
- 0.8 – 1.0: Very High
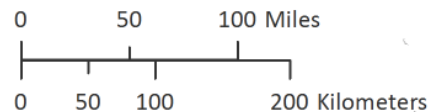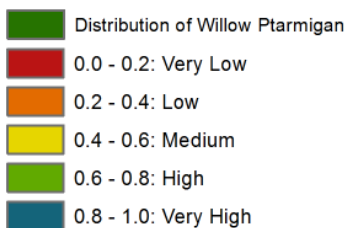
REA Value to RMS

- Rapid Ecoregional Assessments provide baseline conservation data

- Cumulative impacts and landscape condition provide spatial information about important monitoring and conservation opportunities for managers

- Addresses the multiple levels of stressors into one comprehensive assessment

Landscape Approach

Rapid Ecoregional Assessments

Monitoring Frameworks

Science Integration

Regional Conservation Strategy

Mitigation Programs
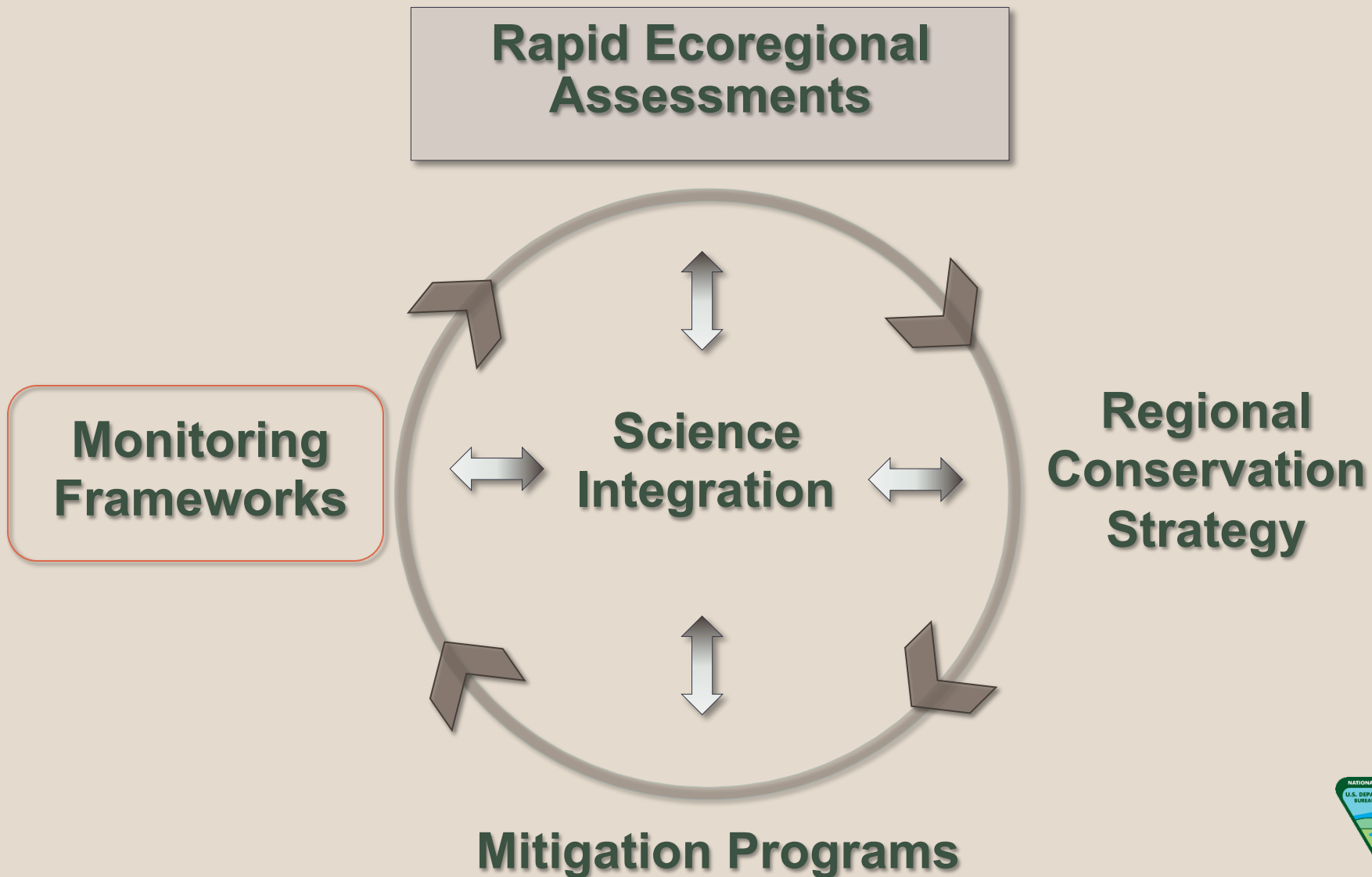
BLM ASSESSMENT, INVENTORY & MONITORING (AIM) *NPR-A*

PILOT PROJECT

BLM Alaska State Office (Scott Guyer)
BLM Arctic Field Office (Dave Yokel)
BLM National Operations Center (Emily Kachergis, Matt Bobo)
Alaska Natural Heritage Program (Tina Boucher)
USDA ARS-Jornada (Jason Karl, Sarah McCord)

Understanding the System: Conceptual Model

Legend
- Ecosystem Drivers
- Change Agents
- Ecosystem Resources
- → Interactions

Anthropogenic Change Agents
- **Communities**
  - Size
  - Location
  - Economic Characteristics
- **Land Use**
  - Oil and Gas
  - Mining
  - Infrastructure
  - Contaminants (local and atmospheric)
- **Commercial / Sport Harvests**

Human activities alter natural processes

Natural processes affect or motivate human activities

Change Agents
- **Climate Change**
- **Fire**
- **Invasive Species**
- **Insects and Disease**

Ecosystem Stressors: Disturbances from human activities can directly and indirectly affect ecosystem drivers and resources

Ecosystem Services: Ecosystem drivers, components, and processes determine possible human activities at a given location
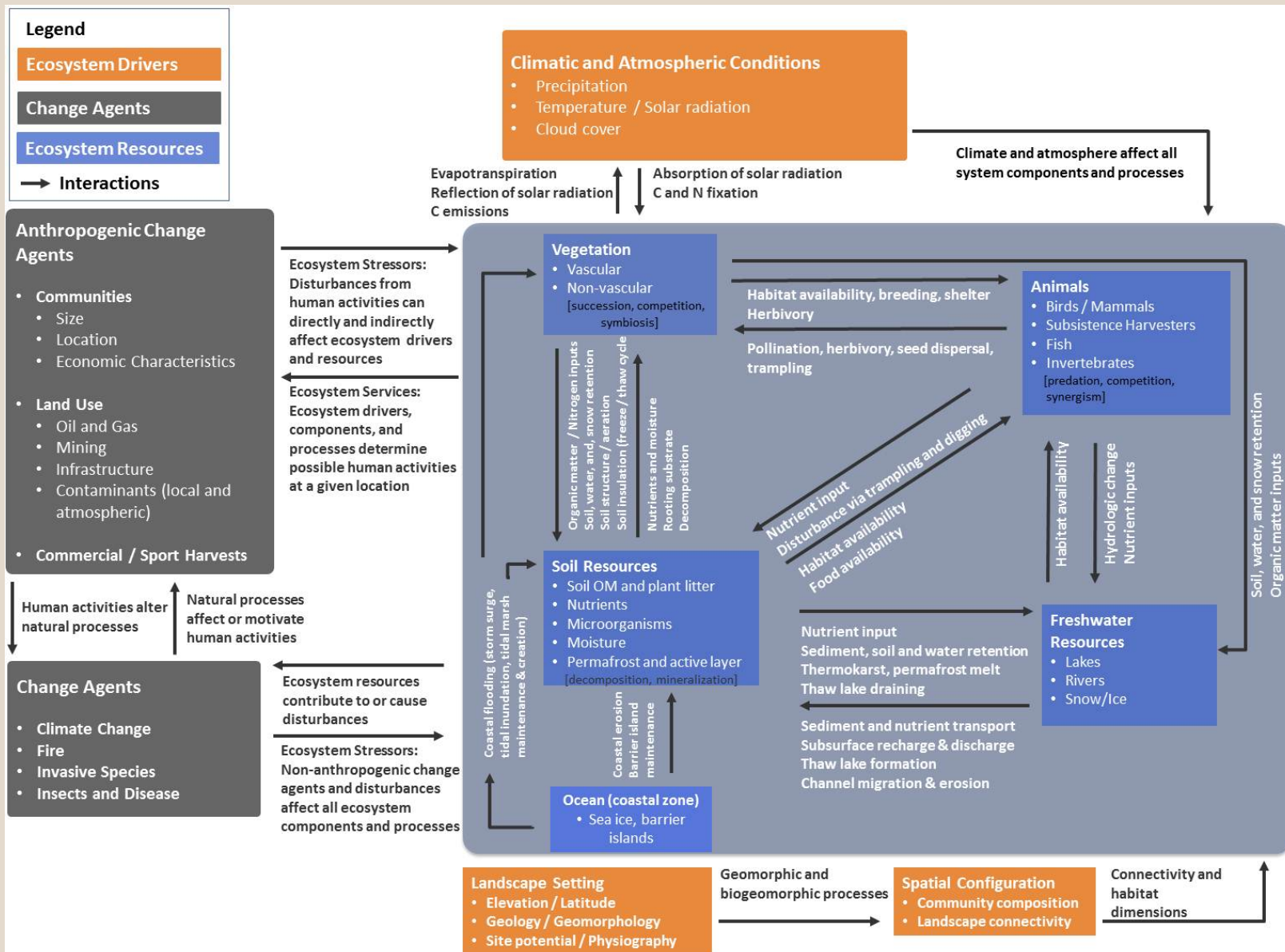
Ecosystem resources contribute to or cause disturbances

Ecosystem Stressors: Non-anthropogenic change agents and disturbances affect all ecosystem components and processes

Climatic and Atmospheric Conditions
- Precipitation
- Temperature / Solar radiation
- Cloud cover

Climate and atmosphere affect all system components and processes

Evapotranspiration
Reflection of solar radiation
C emissions

Absorption of solar radiation
C and N fixation

Vegetation
- Vascular
- Non-vascular
  [succession, competition, symbiosis]

Habitat availability, breeding, shelter
Herbivory

Pollination, herbivory, seed dispersal, trampling

Animals
- Birds / Mammals
- Subsistence Harvesters
- Fish
- Invertebrates
  [predation, competition, synergism]

Organic matter / Nitrogen inputs
Soil, water, and, snow retention
Soil structure / aeration
Soil insulation (freeze / thaw cycle

Nutrients and moisture
Rooting substrate
Decomposition

Nutrient input
Disturbance via trampling and digging
Habitat availability
Food availability

Habitat availability

Hydrologic change
Nutrient inputs

Soil, water, and snow retention
Organic matter inputs

Soil Resources
- Soil OM and plant litter
- Nutrients
- Microorganisms
- Moisture
- Permafrost and active layer
  [decomposition, mineralization]

Coastal flooding (storm surge, tidal inundation, tidal marsh maintenance & creation)

Coastal erosion
Barrier island maintenance

Nutrient input
Sediment, soil and water retention
Thermokarst, permafrost melt
Thaw lake draining

Sediment and nutrient transport
Subsurface recharge & discharge
Thaw lake formation
Channel migration & erosion

Freshwater Resources
- Lakes
- Rivers
- Snow/Ice

Ocean (coastal zone)
- Sea ice, barrier islands

Landscape Setting
- Elevation / Latitude
- Geology / Geomorphology
- Site potential / Physiography

Geomorphic and biogeomorphic processes

Spatial Configuration
- Community composition
- Landscape connectivity

Connectivity and habitat dimensions

BLM
Rapid Ecoregional Assessment

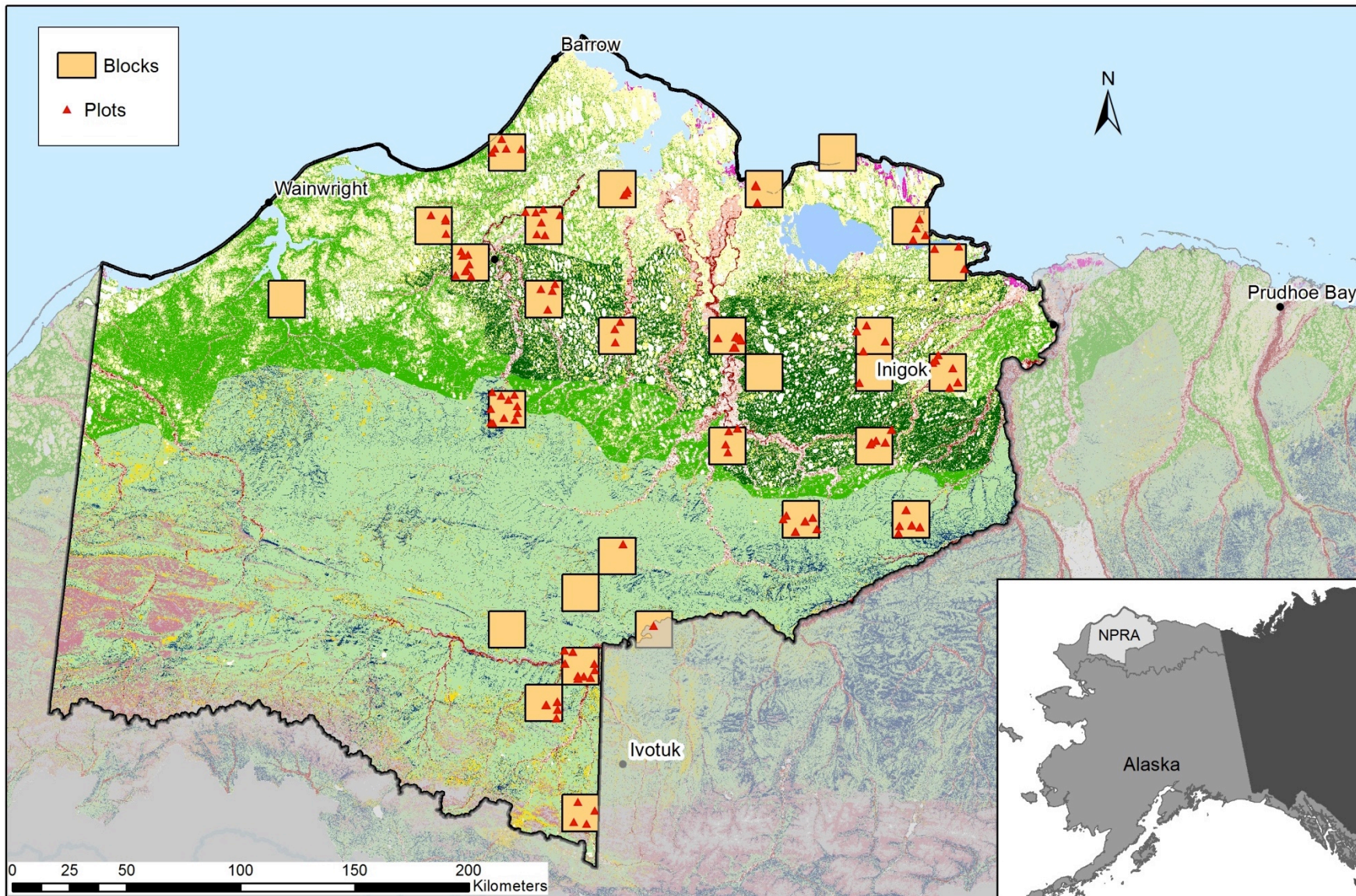# Indicator List *(pilot)*

AIM Core:

- Vegetation composition

- Vegetation height

- Bare ground

- Invasive plant species

- Plant species of management concern

- Proportion of soil surface in large canopy gaps

NPR-A Supplemental:

- Active layer depth

- Moss/duff depth

- Productivity/phenology *

- Surficial permafrost features *

- Surface water *

- Vegetation pattern *

- Area by veg community *

* Collected via remote sensing

Sample Design—Stratification

6%   Alpine Strata
- Alpine Barrens
- Alpine Dwarf Shrub Tundra

50% Brooks Foothills Strata
- Foothills Low Shrub Tundra
- **Foothills Tussock Tundra (43%)**
- Foothills Wet Meadow

40% Coastal Plain Strata
- Coastal Plain Moist Tundra (14%)
- Coastal Plain Wetland (14%)
- Inland Dunes
- Sand Sheet Moist Tundra (8%)
- Sand Sheet Wetland (5%)

4 %   Floodplain Strata
- Floodplain Shrubland
- Floodplain Poorly Drained

<1% Coastal Zone
- Tidal Marsh
- Barrier Islands, Beaches , Spits

Results

- 3 years, 118 plots

- Core Indicators:
  - Composition
  - Structure

- Supplemental Indicators:
  - Active Layer Depth
    (depth to permafrost)
  - Moss / Duff Depth

Thanks!

Questions?

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